

U.S. Serial No. 10/816,913

500.43732X00

IN THE CLAIMS

There are no amendments to the claims, which are reproduced below for the Examiner's convenience.

1. (Original) A storage unit connected communicably to a plurality of other storage units each having a plurality of first hard disk drives on which data is stored, said storage unit comprising:

a plurality of second hard disk drives on which data is stored;

a first receiving unit that receives copies of first storage data and first identifiers from said other storage units, said first storage data being stored in a plurality of storage blocks created by logically partitioning a data storage area of said plurality of first hard disk drives, said first identifiers identifying the storage blocks;

a first operation controller that calculates an exclusive OR of the copies of the first storage data, with a correspondence established among the first identifiers, from the copies of the first storage data received by said first receiving unit from said other storage units; and

a first storage controller that stores a calculation result of the exclusive OR, calculated by said first operation controller, into storage blocks of said second hard disk drives, said storage blocks of said second hard disk drives

U.S. Serial No. 10/816,913

500.43732X00

having second identifiers corresponding to the first identifiers, said second identifiers individually identifying a plurality of storage blocks created by logically partitioning a data storage area of said plurality of second hard disk drives.

2. (Original) The storage unit according to claim 1, wherein all calculation results of the exclusive OR calculated by said first operation controller are stored on said second hard disk drives, said storage unit further comprising:

a second receiving unit that receives a calculation result of an exclusive OR between write data and the first storage data, as well as the first identifier that identifies the storage block in which the write data is to be written, from said other storage unit, said calculation result being calculated by said other storage unit that receives the write data to said first hard disk drives from an information processing unit, said first storage data being stored in the storage block of said first hard disk drives in which the write data is to be written;

a second operation controller that calculates an exclusive OR between the calculation result received by said second receiving unit and second storage data stored in the storage block of said second hard disk drives identified by

U.S. Serial No. 10/816,913

500.43732X00

the second identifier corresponding to the first identifier received by said second receiving unit; and

a second storage controller that stores a calculation result of the exclusive OR, calculated by said second operation controller, into the storage block of said second hard disk drives identified by the second identifier.

3. (Original) The storage unit according to claim 1, wherein all calculation results of the exclusive OR calculated by said first operation controller are stored on said second hard disk drives, said storage unit further comprising, when said other communicably connected storage unit is added:

a third receiving unit that receives a copy of the first storage data and the first identifiers from said added other storage unit, said first storage data being stored in the storage blocks of said first hard disk drives of said added other storage unit;

a third operation controller that calculates an exclusive OR between the copy of said first storage data received by said third receiving unit and second storage data stored in the storage blocks of said second hard disk drives identified by the second identifiers corresponding to the first identifiers received by said third receiving unit; and

a third storage controller that stores a calculation

U.S. Serial No. 10/816,913

500.43732X00

result of the exclusive OR, calculated by said third operation controller, into the storage blocks of said second hard disk drives identified by the second identifiers.

4. (Original) The storage unit according to claim 1, wherein all calculation results of the exclusive OR calculated by said first operation controller are stored on said second hard disk drives, said storage unit further comprising, when said other communicably connected storage unit is added:

a fourth receiving unit that receives a calculation result of an exclusive OR between write data and the first storage data as well as the first identifier, which identifies the storage block into which the write data is to be written, from said added other storage unit, said calculation result being calculated by said added other storage unit that receives the write data to said first hard disk drives of said added other storage from an information processing unit, said first storage data being stored in the storage block of said first hard disk drives in which the write data is to be written;

a fourth operation controller that calculates an exclusive OR between the calculation result received by said fourth receiving unit and second storage data stored in the storage block of said second hard disk drives identified by the second identifier corresponding to the first identifier

U.S. Serial No. 10/816,913

500.43732X00

received by said fourth receiving unit; and

a fourth storage controller that stores a calculation result of the exclusive OR, calculated by said fourth operation controller, into the storage block of said second hard disk drives identified by the second identifier.

5. (Original) The storage unit according to claim 1, wherein all calculation results of the exclusive OR calculated by said first operation controller are stored on said second hard disk drives, said storage unit further comprising:

a fifth receiving unit that receives, from one of said other storage units, a request to send the first storage data to be stored in said first hard disk drives of said one of said other storage units;

a first sending unit that sends a request to send a copy of the first storage data, which is stored in the storage blocks of said first hard disk drives, as well as the first identifiers that identify the storage blocks in which the first storage data is stored, to said other storage units other than said one of said other storage units;

a sixth receiving unit that receives the copy of the first storage data as well as the first identifiers from each of the other storage units other than said one of said other storage units;

U.S. Serial No. 10/816,913

500.43732X00

a fifth operation controller that calculates an exclusive OR between copies of the first storage data and second storage data, said copies of the first storage data being the copies of the first storage data received by said sixth receiving unit from said other storage units other than said one of other storage units and corresponding to the first identifiers, said second storage data being stored in the storage blocks of said second hard disk drives identified by the second identifiers corresponding to the first identifiers received by said sixth receiving unit; and

a second sending unit that sends a calculation result of the exclusive OR calculated by said fifth operation controller, as well as the first identifiers, to said one of said other storage unit.

6. (Original) A method of controlling a storage unit connected communicably to a plurality of other storage units each having a plurality of first hard disk drives on which data is stored and having a plurality of second hard disk drives on which data is stored, said method comprising the steps of:

receiving copies of first storage data and first identifiers from said other storage units, said first storage data being stored in a plurality of storage blocks created by logically partitioning a data storage area of said plurality

U.S. Serial No. 10/816,913

500.43732X00

of first hard disk drives, said first identifiers identifying the storage blocks,

calculating an exclusive OR of the copies of the first storage data, with a correspondence established among the first identifiers, from the copies of the first storage data received from said other storage units; and

storing a calculation result of the exclusive OR into storage blocks of said second hard disk drives, said storage blocks of said second hard disk drives having second identifiers corresponding to the first identifiers, said second identifiers individually identifying a plurality of storage blocks created by logically partitioning a data storage area of said plurality of second hard disk drives.

7. (Original) The method of controlling a storage unit according to claim 6, wherein all calculation results of the exclusive OR are stored on said second hard disk drives, said method further comprising the steps of:

receiving a calculation result of an exclusive OR between write data and the first storage data, as well as the first identifier that identifies the storage block in which the write data is to be written, from said other storage unit, said calculation result being calculated by said other storage unit that receives the write data to said first hard disk drives from an information processing unit, said first storage

U.S. Serial No. 10/816,913

500.43732X00

data being stored in the storage block of said first hard disk drives in which the write data is to be written;

calculating an exclusive OR between the calculation result and second storage data stored in the storage block of said second hard disk drives identified by the second identifier corresponding to the first identifier; and

storing a calculation result of the exclusive OR into the storage block of said second hard disk drives identified by the second identifier.

8. (Original) The method of controlling a storage unit according to claim 6, wherein all calculation results of the exclusive OR are stored on said second hard disk drives, said method further comprising the steps of, when said other communicably connected storage unit is added:

receiving a copy of the first storage data and the first identifiers from said added other storage unit, said first storage data being stored in the storage blocks of said first hard disk drives of said added other storage unit;

calculating an exclusive OR between the copy of said first storage data and second storage data stored in the storage blocks of said second hard disk drives identified by the second identifiers corresponding to the first identifiers; and

storing a calculation result of the exclusive OR

U.S. Serial No. 10/816,913

500.43732X00

into the storage blocks of said second hard disk drives identified by the second identifiers.

9. (Original) The method of controlling a storage unit according to claim 6, wherein all calculation results of the exclusive OR are stored on said second hard disk drives, said method further comprising the steps of, when said other communicably connected storage unit is added:

receiving a calculation result of an exclusive OR between write data and the first storage data as well as the first identifier, which identifies the storage block into which the write data is to be written, from said added other storage unit, said calculation result being calculated by said added other storage unit that receives the write data to said first hard disk drives of said added other storage from an information processing unit, said first storage data being stored in the storage block of said first hard disk drives in which the write data is to be written;

calculating an exclusive OR between the calculation result and second storage data stored in the storage block of said second hard disk drives identified by the second identifier corresponding to the first identifier; and

storing a calculation result of the exclusive OR into the storage block of said second hard disk drives identified by the second identifier.

U.S. Serial No. 10/816,913

500.43732X00

10. (Original) The method of controlling a storage unit according to claim 6, wherein all calculation results of the exclusive OR are stored on said second hard disk drives, said method further comprising the steps of:

receiving, from one of said other storage units, a request to send the first storage data to be stored in said first hard disk drives of said one of said other storage units;

sending a request to send a copy of the first storage data, which is stored in the storage blocks of said first hard disk drives, as well as the first identifiers that identify the storage blocks in which the first storage data is stored, to said other storage units other than said one of said other storage units;

receiving the copy of the first storage data as well as the first identifiers from each of the other storage units other than said one of said other storage units;

calculating an exclusive OR between copies of the first storage data and second storage data, said copies of the first storage data being the copies of the first storage data from said other storage units other than said one of other storage units and corresponding to the first identifiers, said second storage data being stored in the storage blocks of said second hard disk drives identified by the second identifiers

U.S. Serial No. 10/816,913

500.43732X00

corresponding to the first identifiers; and

sending a calculation result of the exclusive OR as well as the first identifiers to said one of said other storage unit.

11. (Original) A storage system comprising a plurality of first storage units each having a plurality of first hard disk drives on which data is stored; and a second storage unit connected communicably to the first storage units and having a plurality of second hard disk drives on which data is stored,

wherein said first storage unit comprises:

a first data sending unit that sends a copy of first storage data and first identifiers to said second storage unit, said first storage data being stored in a plurality of storage blocks created by logically partitioning a data storage area of said plurality of first hard disk drives, said first identifiers identifying the storage blocks,

said second storage unit comprises:

a first data receiving unit that receives copies of the first storage data and the first identifiers from said first storage units;

a first data operation controller that calculates an exclusive OR of the copies of the first storage data, with a correspondence established among the first identifiers, from

U.S. Serial No. 10/816,913

500.43732X00

the copies of the first storage data received by said first receiving unit from said first storage units; and

a first data storage controller that stores a calculation result of the exclusive OR, calculated by said first data operation controller, into storage blocks of said second hard disk drives, said storage blocks of said second hard disk drives having second identifiers corresponding to the first identifiers, said second identifiers individually identifying a plurality of storage blocks created by logically partitioning a data storage area of said plurality of second hard disk drives.

12. (Original) The storage system according to claim 11 wherein all calculation results of the exclusive OR calculated by said first data operation controller are stored on said second hard disk drives,

wherein said first storage unit further comprises:

a second data operation controller that, when write data to said first hard disk drives is received from an information processing unit, calculates an exclusive OR between the write data and the first storage data stored in the storage block of said first hard disk drives into which the write data is to be written; and

a second data sending unit that sends a calculation result of the exclusive OR calculated by said second data

U.S. Serial No. 10/816,913

500.43732X00

operation controller, as well as said first identifier that identifies the storage block into which the write data is to be written, to said second storage unit, and

said second storage unit comprises:

a second data receiving unit that receives a calculation result of the exclusive OR, calculated by said second data operation controller, as well as the first identifier, from said first storage unit;

a third data operation controller that calculates an exclusive OR between the calculation result received by said second data receiving unit and second storage data stored in the storage block of said second hard disk drives identified by the second identifier corresponding to the first identifier received by said second data receiving unit, and

a second data storage controller that stores a calculation result of the exclusive OR, calculated by said third data operation controller, into the storage block of said second hard disk drives identified by the second identifier.

13. (Original) The storage system according to claim 11, wherein all calculation results of the exclusive OR calculated by said first data operation controller are stored on said second hard disk drives,

wherein said second storage unit further comprises:

U.S. Serial No. 10/816,913

500.43732X00

a third data sending unit that, when said first storage unit connected communicably to said second storage unit is added, sends a request to send a copy of the first storage data stored in the storage blocks of said first hard disk drives, as well as the first identifiers that identify the storage blocks in which the first storage data is stored, to said added first storage unit,

said first storage unit further comprises:

a fourth data sending unit that, in response to the request to send, sends the copy of the first storage data stored in the storage blocks of said first hard disk drives, as well as the first identifiers, to said second storage unit,

said second storage unit further comprises:

a third data receiving unit that receives the copy of the first storage data, as well as the first identifiers, from said first storage unit;

a fourth data operation controller that calculates an exclusive OR between the copy of the first storage data received by said third data receiving unit and second storage data stored in the storage blocks of said second hard disk drives identified by the second identifiers corresponding to the first identifiers received by said third data receiving unit; and

a third data storage controller that stores a calculation result of the exclusive OR calculated by said

U.S. Serial No. 10/816,913

500.43732X00

fourth data operation controller into the storage blocks of said second hard disk drives identified by said second identifiers.

14. (Original) The storage system according to claim 11, wherein all calculation results of the exclusive OR calculated by said first data operation controller are stored on said second hard disk drives,

wherein, when said first storage unit connected communicably to said second storage unit is added, said added first storage unit further comprises:

a fifth data operation controller that, when write data to said first hard disk drives is received from an information processing unit, calculates an exclusive OR between the write data and the first storage data stored in the storage block of said first hard disk drives into which the write data is to be written; and

a fifth data sending unit that sends a calculation result of the exclusive OR calculated by said fifth data operation controller, as well as the first identifier identifying the storage block into which the write data is to be written, to said second storage unit, and

said second storage unit further comprises:

a fourth data receiving unit that receives a calculation result of the exclusive OR calculated by said fifth data operation controller, as well as the first

U.S. Serial No. 10/816,913

500.43732X00

identifier, from said added first storage unit;

a sixth data operation controller that calculates an exclusive OR between the calculation result received by said fourth data receiving unit and second storage data stored in the storage block of said second hard disk drives identified by said second identifier corresponding to the first identifier received by said fourth data receiving unit; and

a fourth data storage controller that stores a calculation result of the exclusive OR calculated by said sixth data operation controller into the storage block of said second hard disk drives identified by said second identifier.

15. (Original) The storage system according to claim 11, wherein all calculation results of the exclusive OR calculated by said first data operation controller are stored on said second hard disk drives,

wherein said first storage unit further comprises:

a sixth data sending unit that sends a request to send the first storage data to be stored in said first hard disk drives of said first storage unit to said second storage unit,

said second storage unit further comprises:

a fifth data receiving unit that receives the request to send the first storage data from said first storage unit;

U.S. Serial No. 10/816,913

500.43732X00

a seventh data sending unit that, in response to the request to send the first storage data, sends a request to send a copy of the first storage data, which is stored in the storage blocks of said first hard disk drives, as well as the first identifiers that identify the storage blocks in which the first storage data is stored, to said first storage units other than said first storage unit that has sent the request to send said first storage data;

a sixth data receiving unit that receives the copy of the first storage data, as well as the first identifiers, from each of said first storage units other than said first storage unit that has sent the request to send the first storage data;

a seventh data operation controller that calculates an exclusive OR between copies of the first storage data and second storage data, said copies of the first storage data being the copies of the first storage data received by said sixth data receiving unit and corresponding to the first identifiers, said second storage data being stored in the storage blocks of said second hard disk drives identified by the second identifiers corresponding to the first identifiers received by said sixth receiving unit; and

an eighth data sending unit that sends a calculation result of the exclusive OR calculated by said seventh data operation controller, as well as the first identifiers, to

U.S. Serial No. 10/816,913

500.43732X00

said first storage unit that has sent the request to send the first storage data, and,

said first storage unit further comprises:

a seventh data receiving unit that receives a calculation result of the exclusive OR calculated by said seventh data operation controller, as well as the first identifiers, from said second storage unit; and

a fifth data storage controller that stores the calculation result of the exclusive OR, received by said seventh data receiving unit, into the storage blocks of said first hard disk drives identified by the first identifiers received by said seventh data receiving unit.